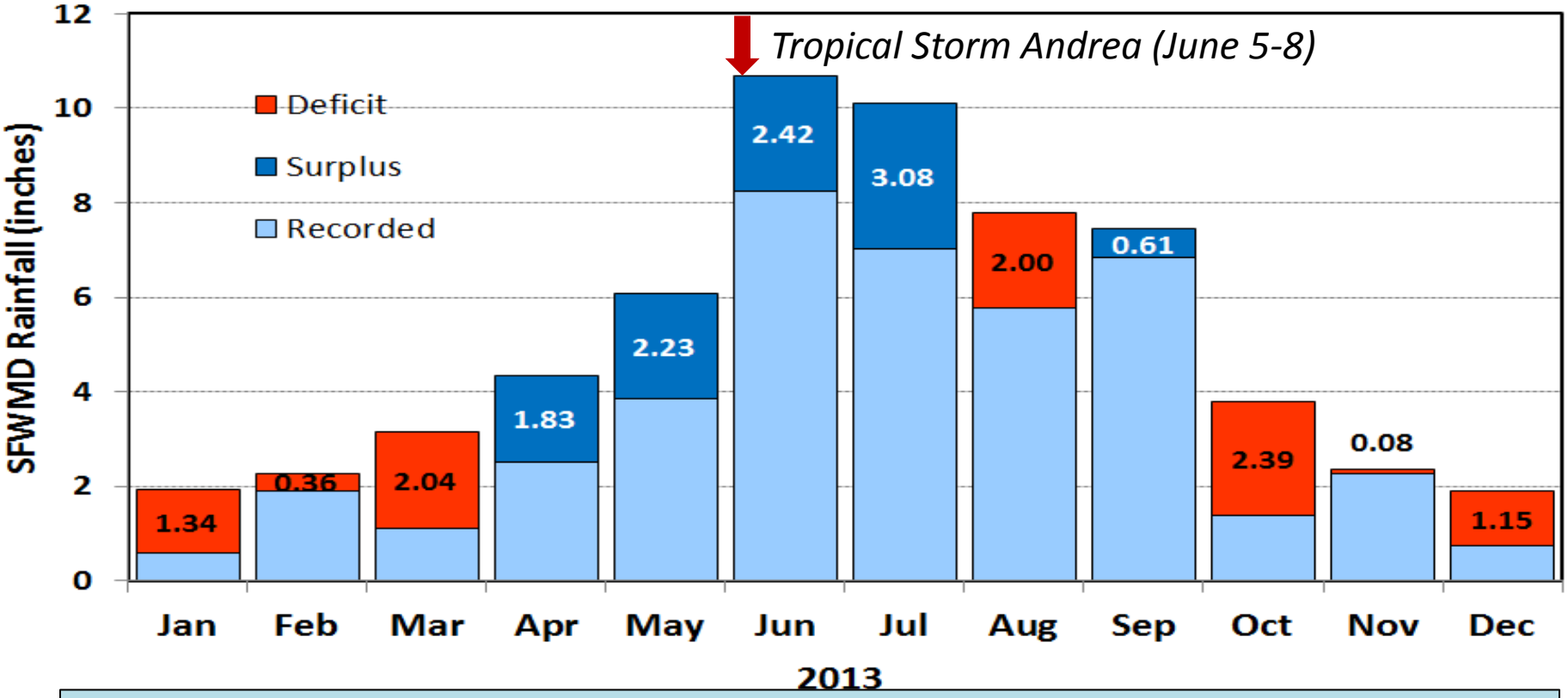
SFWMD Presentation to the
Water Resources Advisory Commission
West Palm Beach, Florida
March 6, 2014

2013 Wet Season: Summary of Central and Southern Florida Water Management System Conditions and Operations

- Can more water be sent south to the WCAs/STAs?
- Can more water be sent to Holey Land and Rotenberger WMAs?
- Can more water be held in the Lake?
- Can more water be held in the Kissimmee?

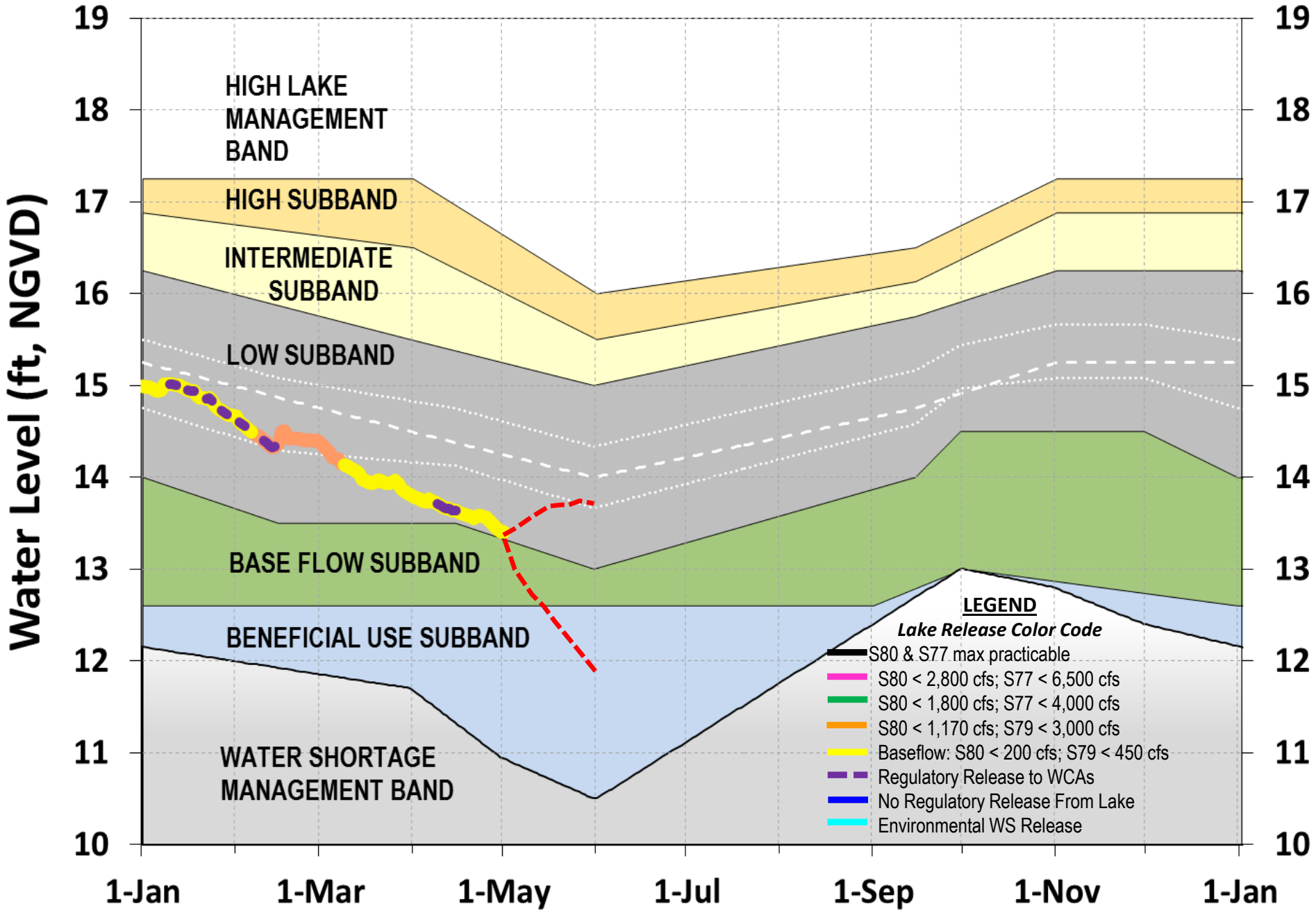
2013 SFWMD Monthly Rainfall



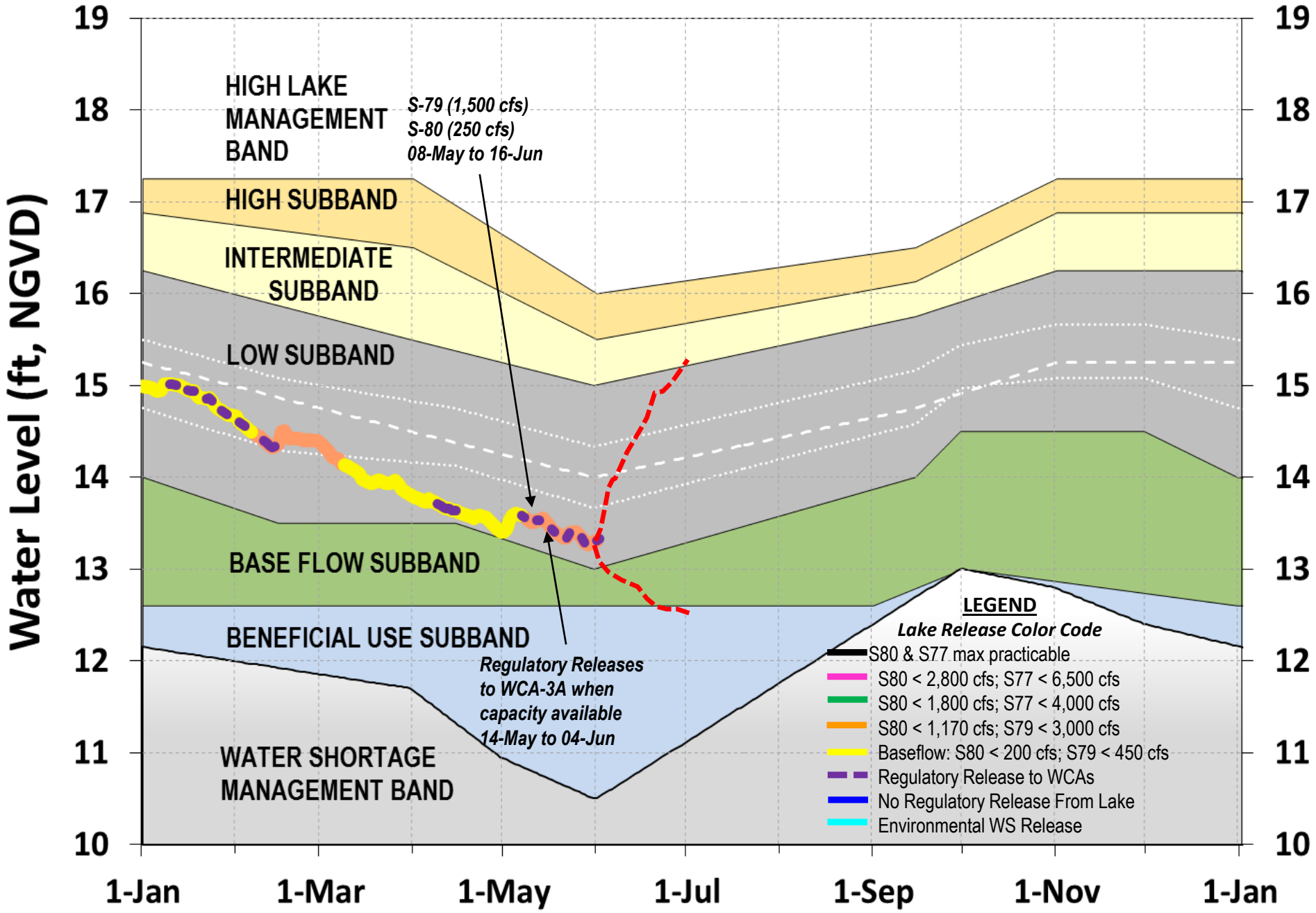
2013 WET SEASON:

- Early start (May 18th) & early end (Oct 8th)
- Wettest April-July on record (46% above average)
- Tropical Storm Andrea (3.1” district-wide)
- Very wet antecedent conditions at beginning of August with peak of hurricane season ahead
- **It was wet everywhere across the 16 counties**

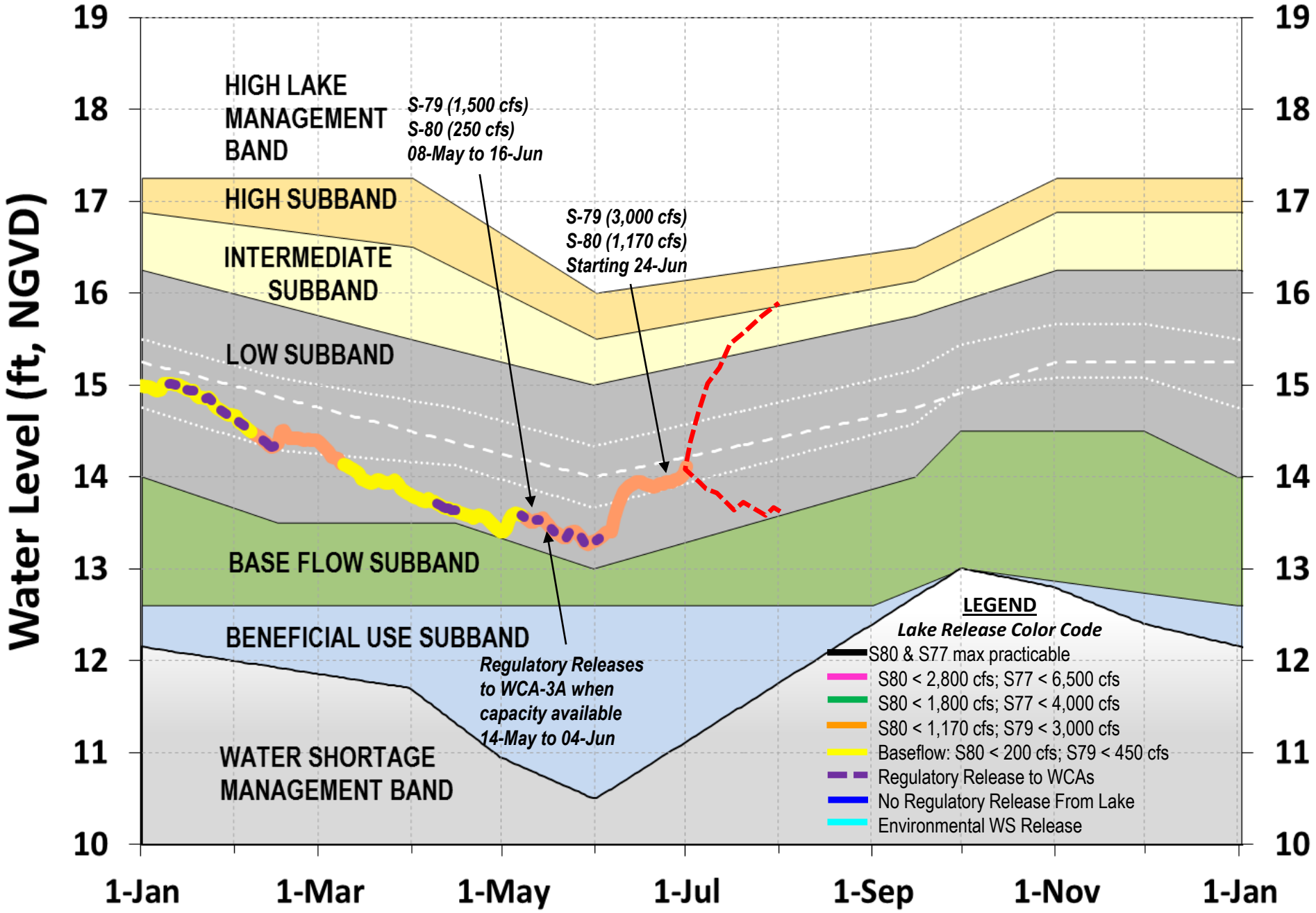
2013 Lake Okeechobee Water Level and Releases



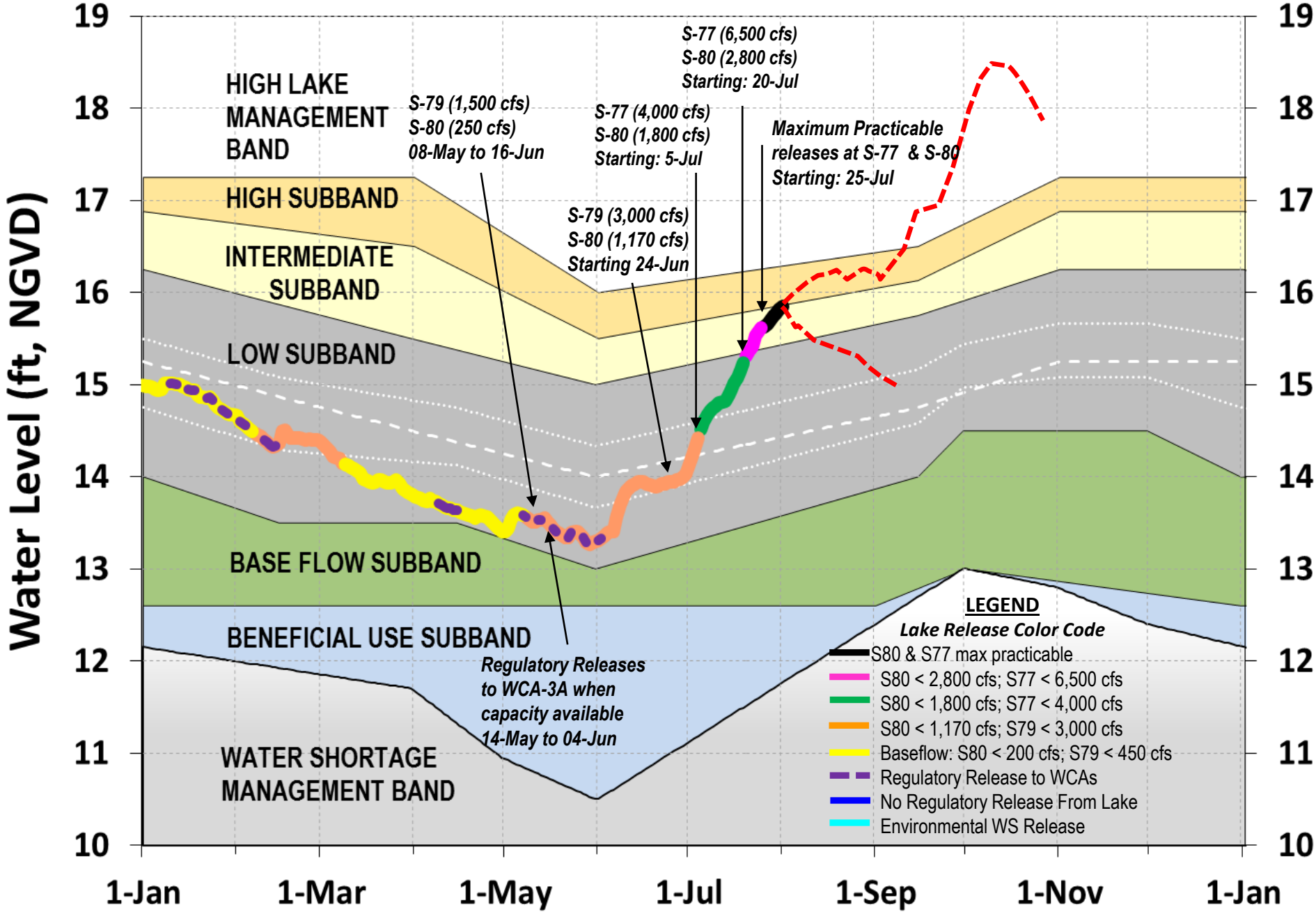
2013 Lake Okeechobee Water Level and Releases



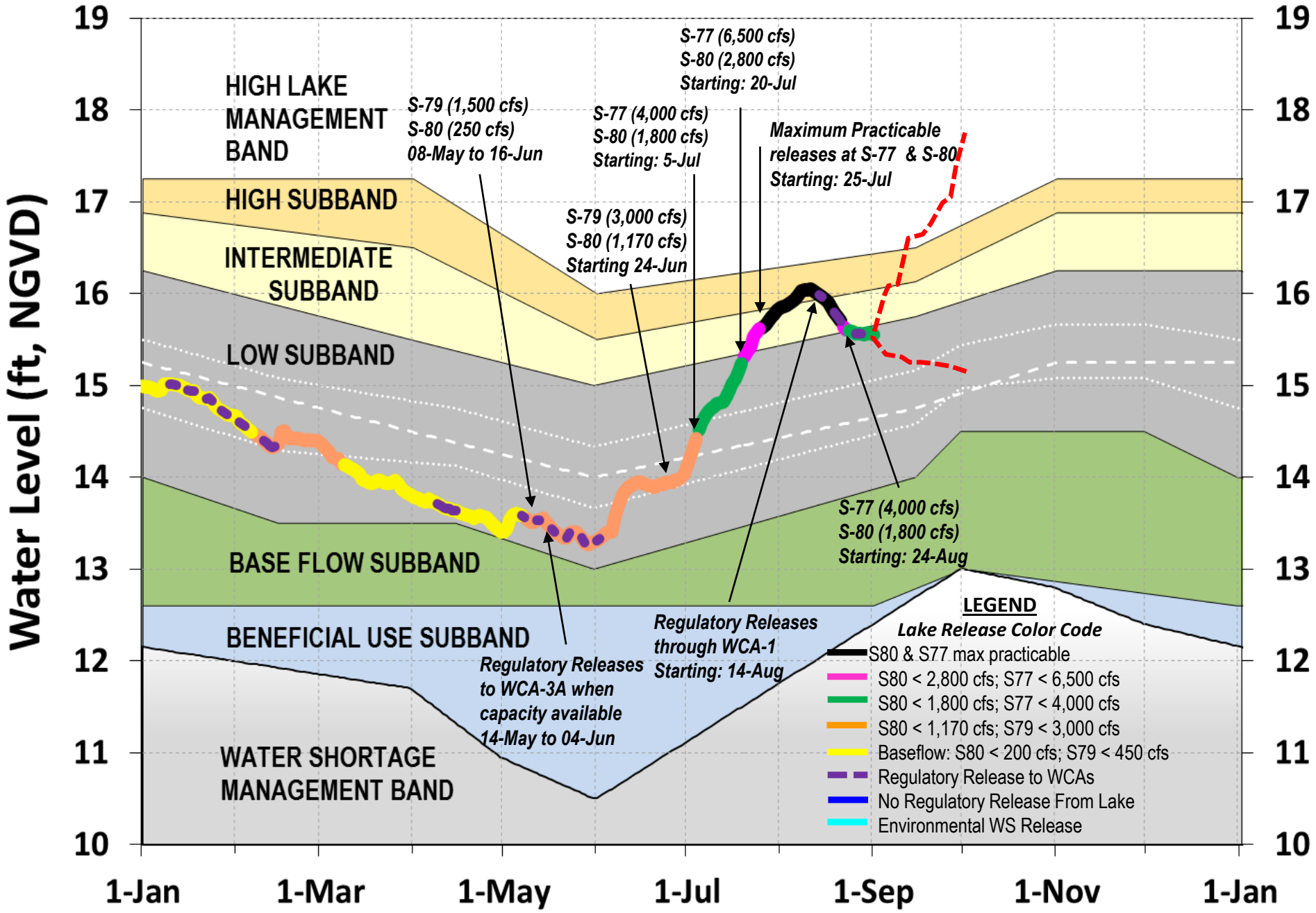
2013 Lake Okeechobee Water Level and Releases



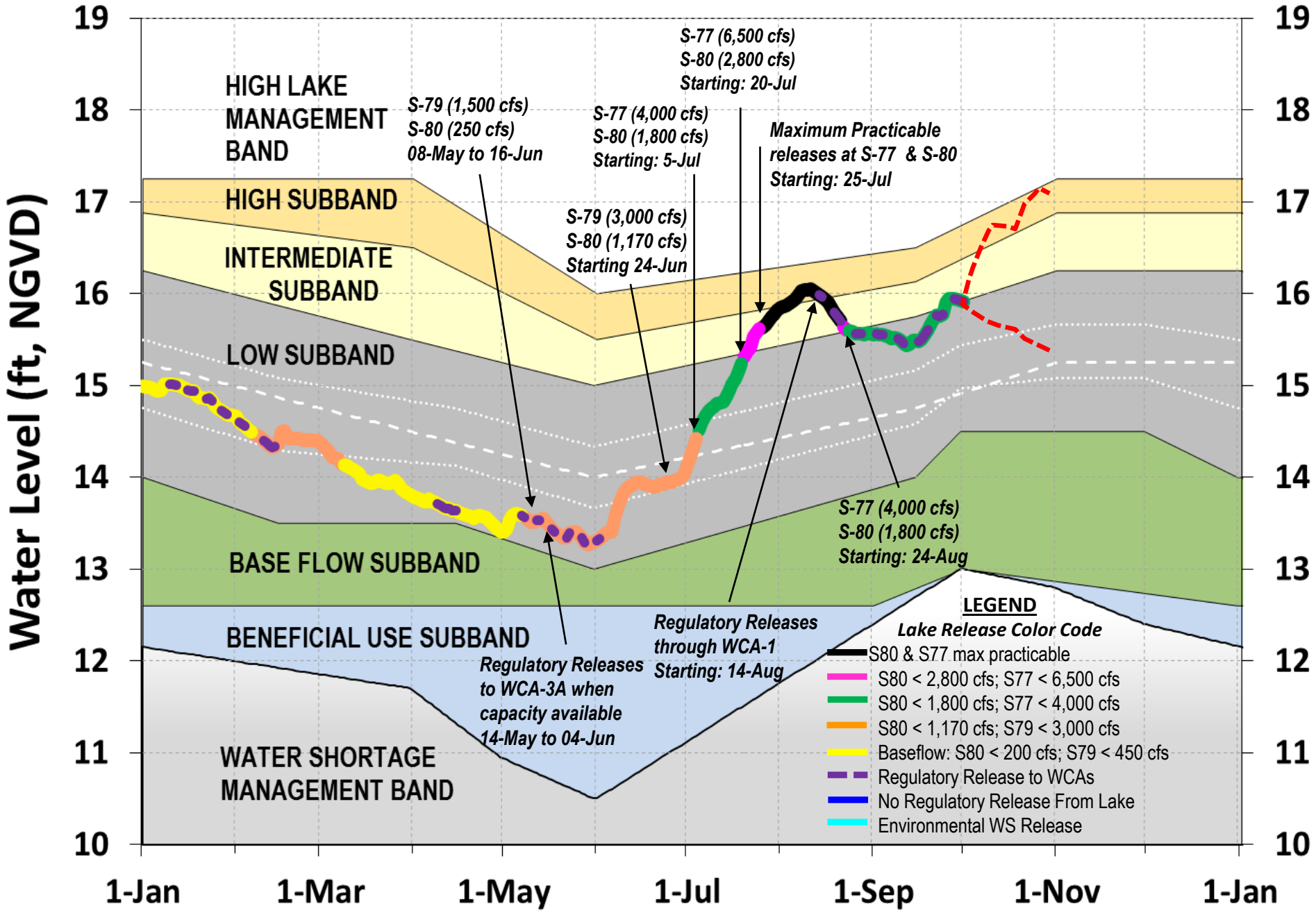
2013 Lake Okeechobee Water Level and Releases



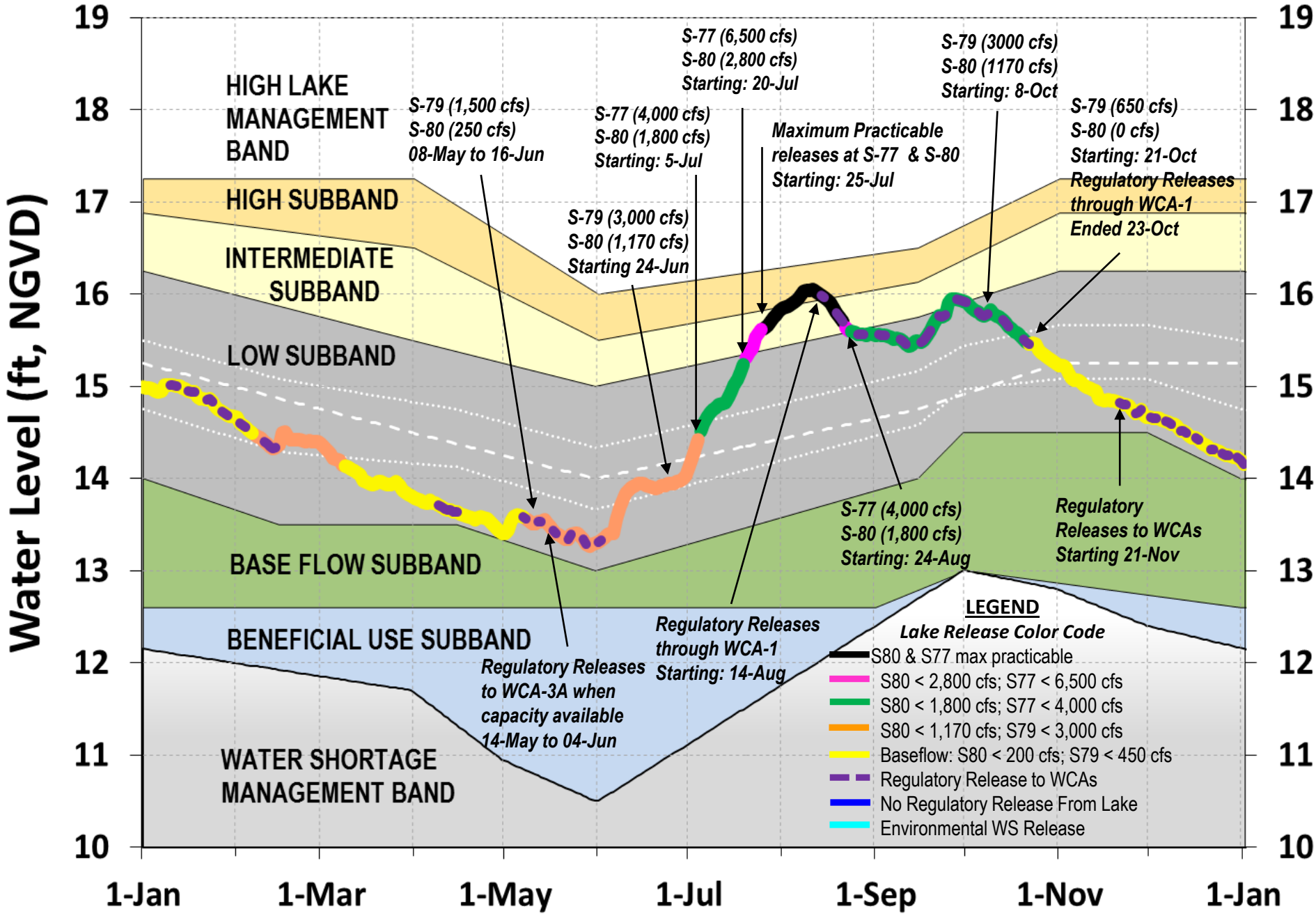
2013 Lake Okeechobee Water Level and Releases



2013 Lake Okeechobee Water Level and Releases

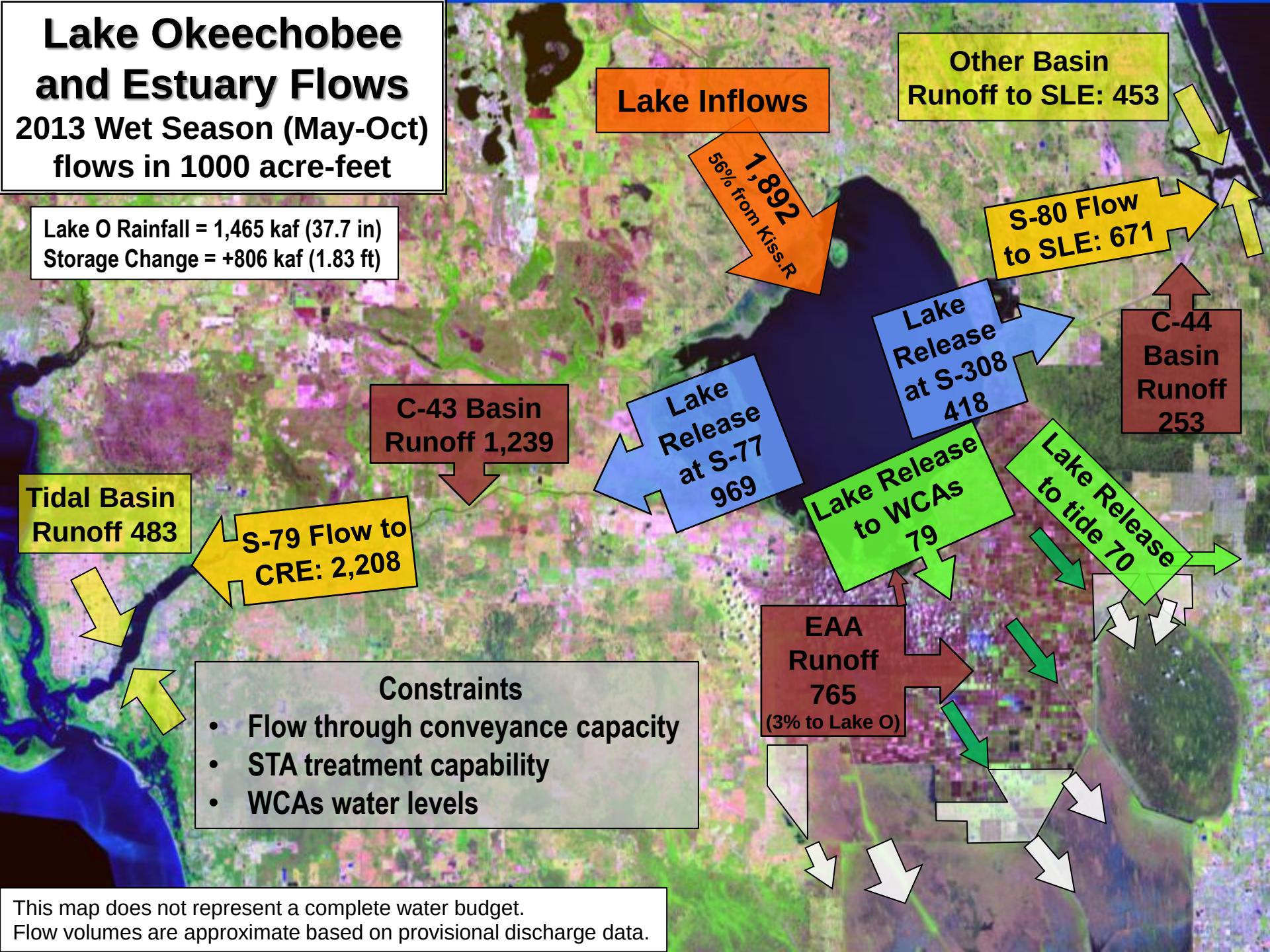


2013 Lake Okeechobee Water Level and Releases



Lake Okeechobee and Estuary Flows

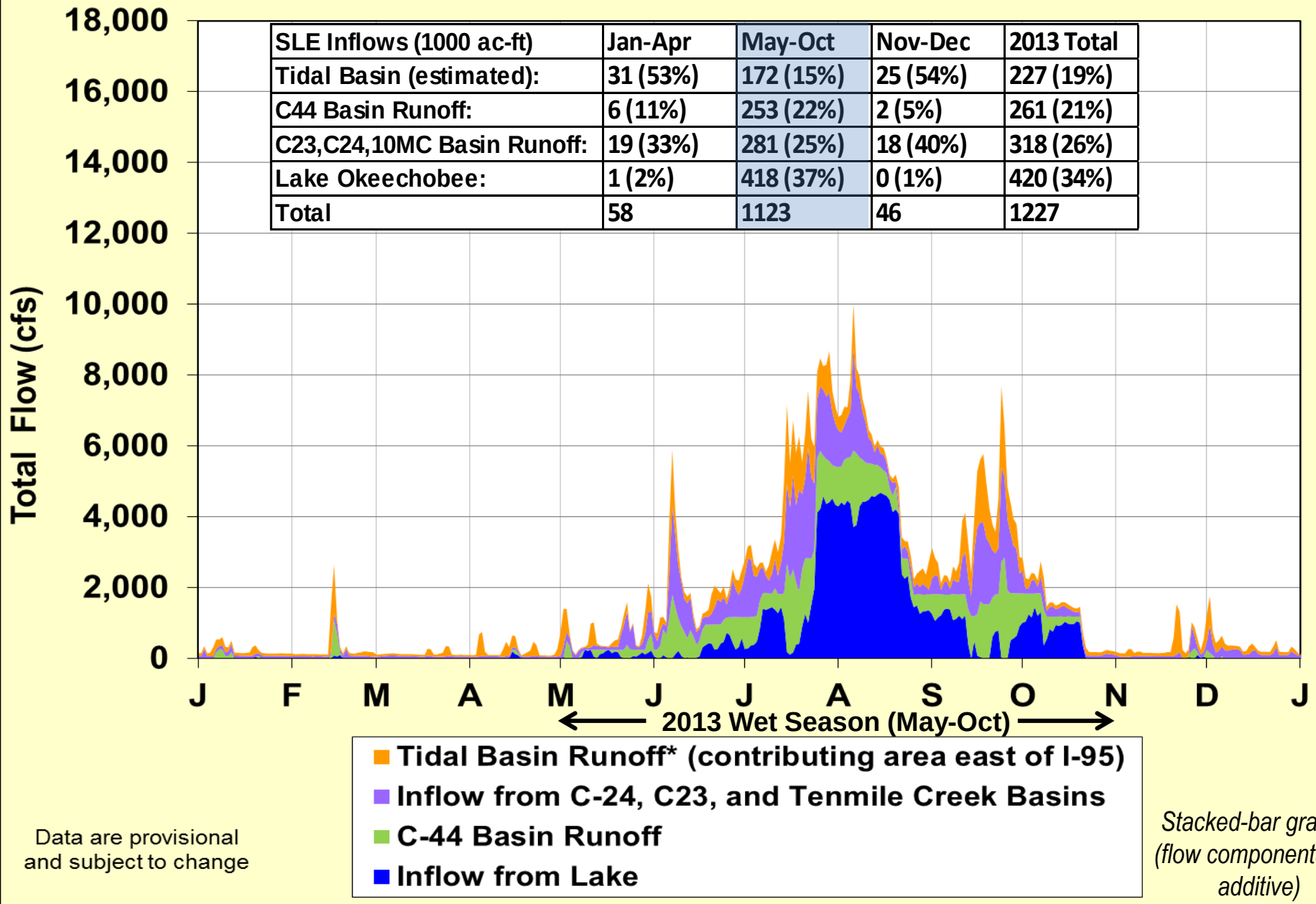
2013 Wet Season (May-Oct) flows in 1000 acre-feet



This map does not represent a complete water budget.
Flow volumes are approximate based on provisional discharge data.

2013 Discharges to the St. Lucie Estuary

SLE Inflows (1000 ac-ft)	Jan-Apr	May-Oct	Nov-Dec	2013 Total
Tidal Basin (estimated):	31 (53%)	172 (15%)	25 (54%)	227 (19%)
C44 Basin Runoff:	6 (11%)	253 (22%)	2 (5%)	261 (21%)
C23,C24,10MC Basin Runoff:	19 (33%)	281 (25%)	18 (40%)	318 (26%)
Lake Okeechobee:	1 (2%)	418 (37%)	0 (1%)	420 (34%)
Total	58	1123	46	1227

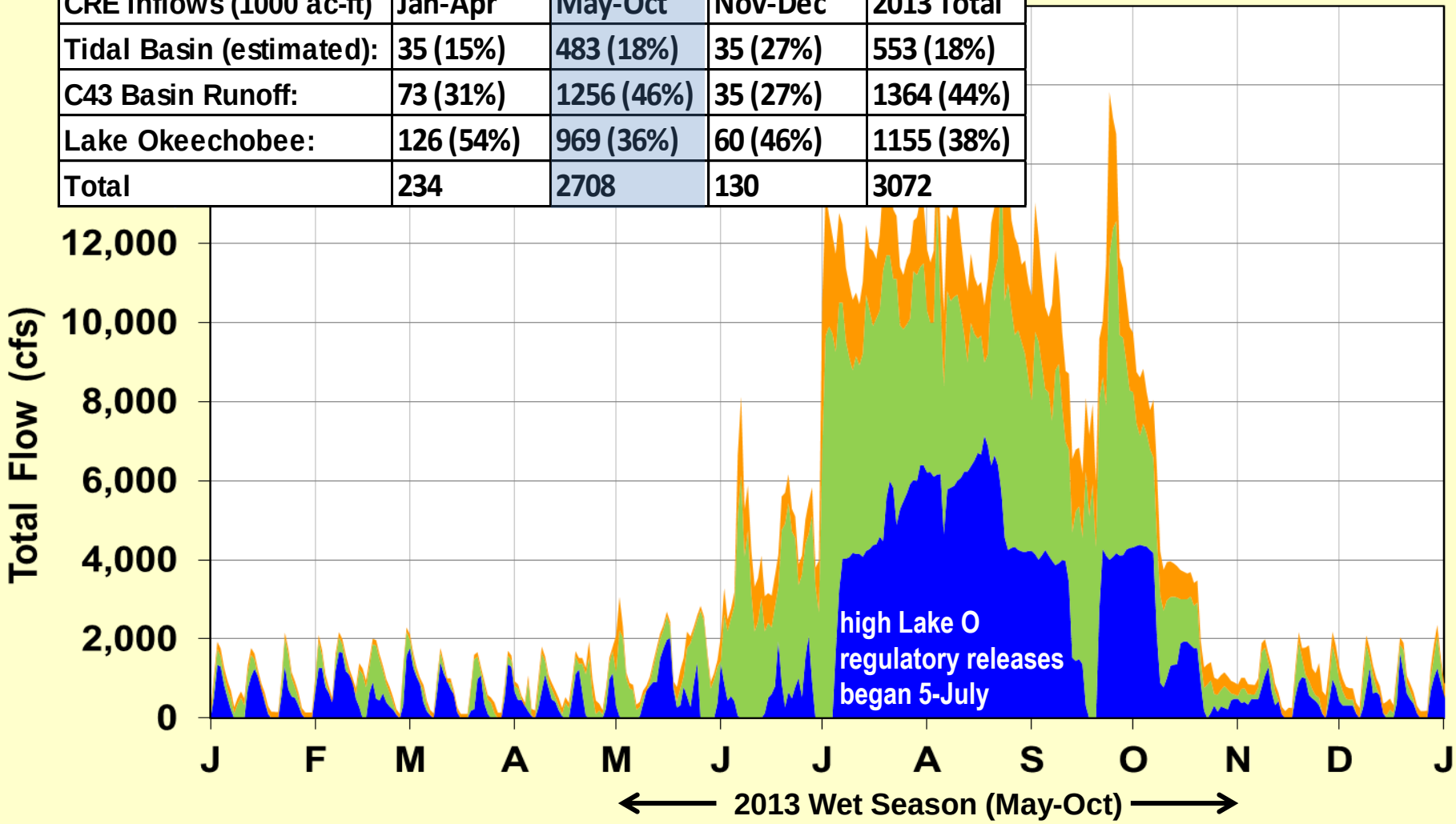


Data are provisional and subject to change

Stacked-bar graphic (flow components are additive)

2013 Discharges to the Caloosahatchee Estuary

CRE Inflows (1000 ac-ft)	Jan-Apr	May-Oct	Nov-Dec	2013 Total
Tidal Basin (estimated):	35 (15%)	483 (18%)	35 (27%)	553 (18%)
C43 Basin Runoff:	73 (31%)	1256 (46%)	35 (27%)	1364 (44%)
Lake Okeechobee:	126 (54%)	969 (36%)	60 (46%)	1155 (38%)
Total	234	2708	130	3072



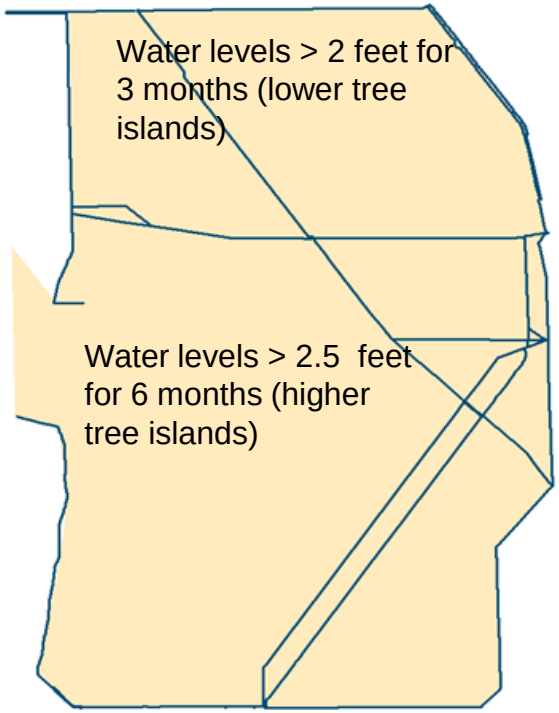
Data are provisional and subject to change

Stacked-bar graphic (flow components are additive)

- Can more water be sent south to the WCAs/STAs/WMAs?

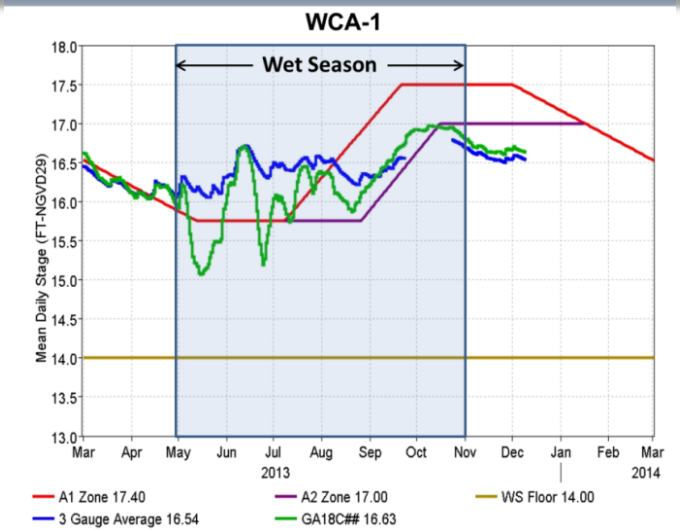
Lake Okeechobee & WCA Regulation Schedules

- **LORS 2008 provides operational guidance**
  - **EAA canal capacity and basin flood protection**
  - **WCAs ability to accept water, i.e., "*when desirable or with minimal Everglades impacts*"**
    - **Regulation schedules: consider wildlife, WCA ecology, and levee integrity**

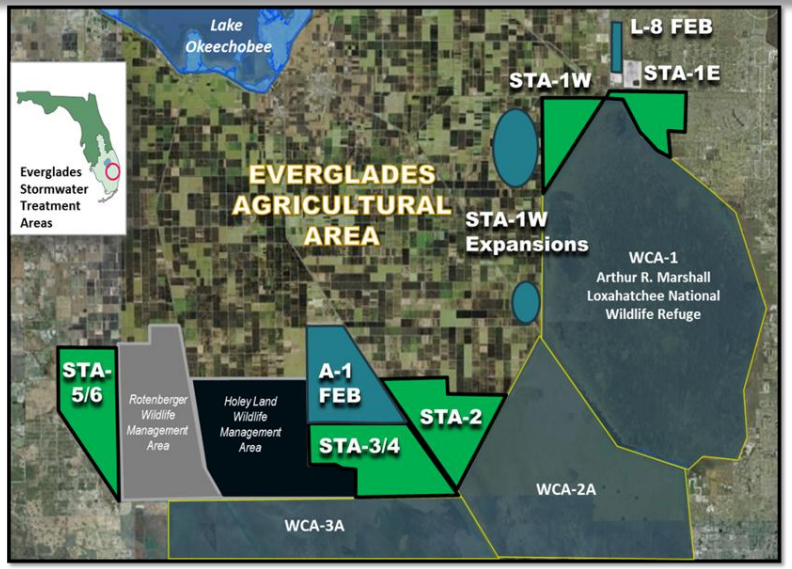


WCA Water Levels & Constraints

- Early wet season - stages were above regulation in all WCAs
- When Lake Okeechobee entered the Intermediate band (July 20), LORS prevented releases to WCAs when stage 0.25+ foot above schedule
- Directed Lake Releases to WCA-1 and WCA-2 then to tide
- Physical constraints at south end of WCA-3A



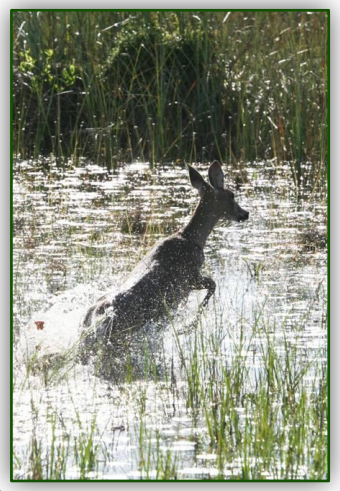
Stormwater Treatment Area Constraints

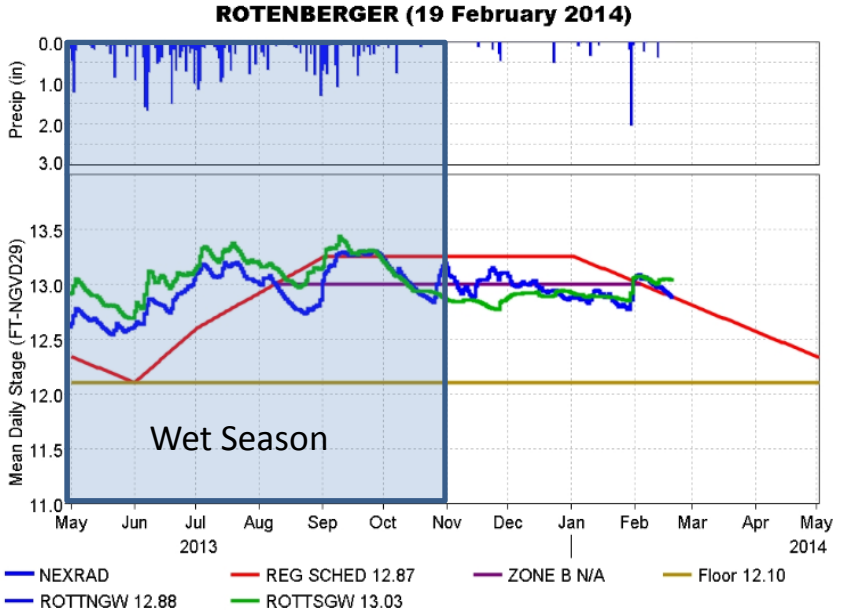


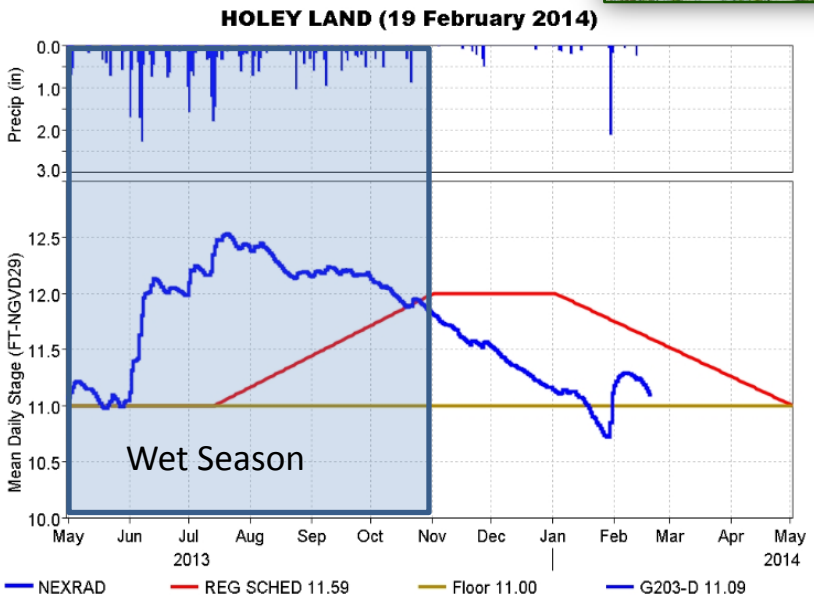
- Designed to reduce TP concentrations and achieve compliance with water quality standards for existing flows
- Operated within constraints of state & federal law - permits, consent orders, and operations plans
- Since STAs do not meet current discharge limits, they are operated under Consent Orders with requirements to
  - maximize TP concentration reductions while additional Restoration Strategies projects are constructed and Science Plan is implemented
- Operational considerations: antecedent depth/flow, vegetation conditions, current treatment performance, Endangered Species Act / Migratory Bird Treaty Act, ongoing construction/rehabilitation activities

Wildlife Management Area Constraints

- Outstanding Florida Waters
- Managed by FWC and SFWMD
  - Per regulation schedules and permits
  - For protection of water quality, recreation & wildlife
- Holey Land - above schedule May - late October. Minimal opportunities for water storage
- Rotenberger - above schedule May - July. Pumped STA treated water to Rotenberger July - January.

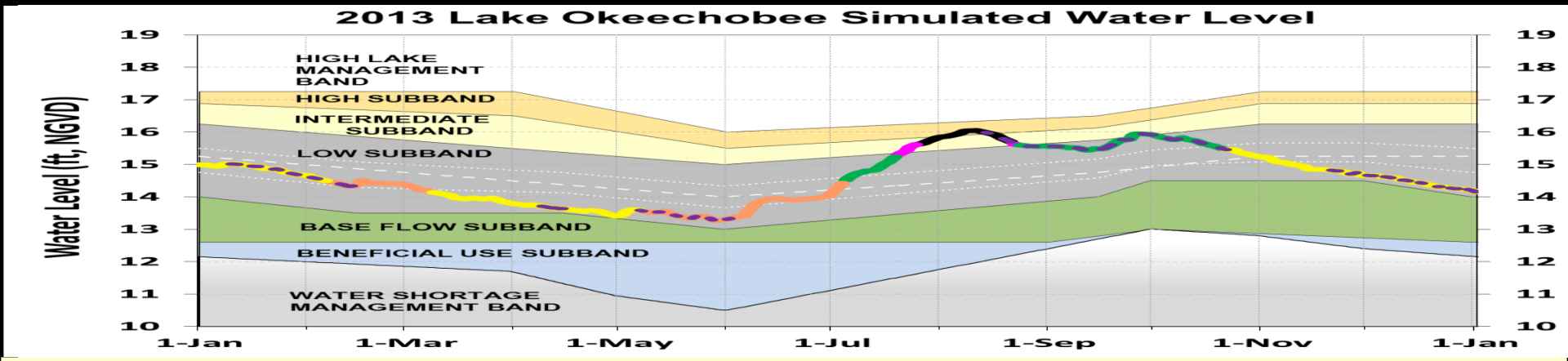


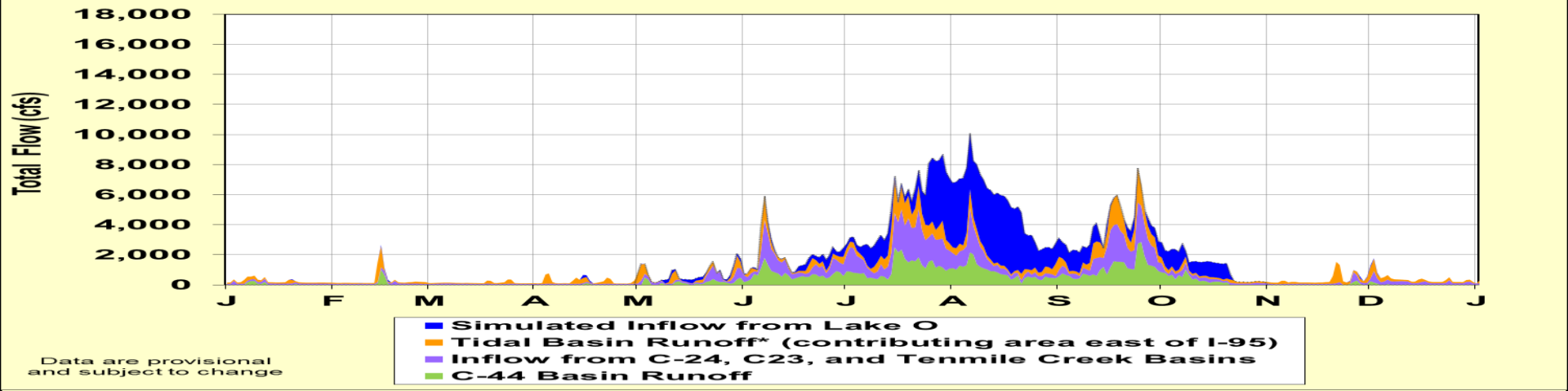


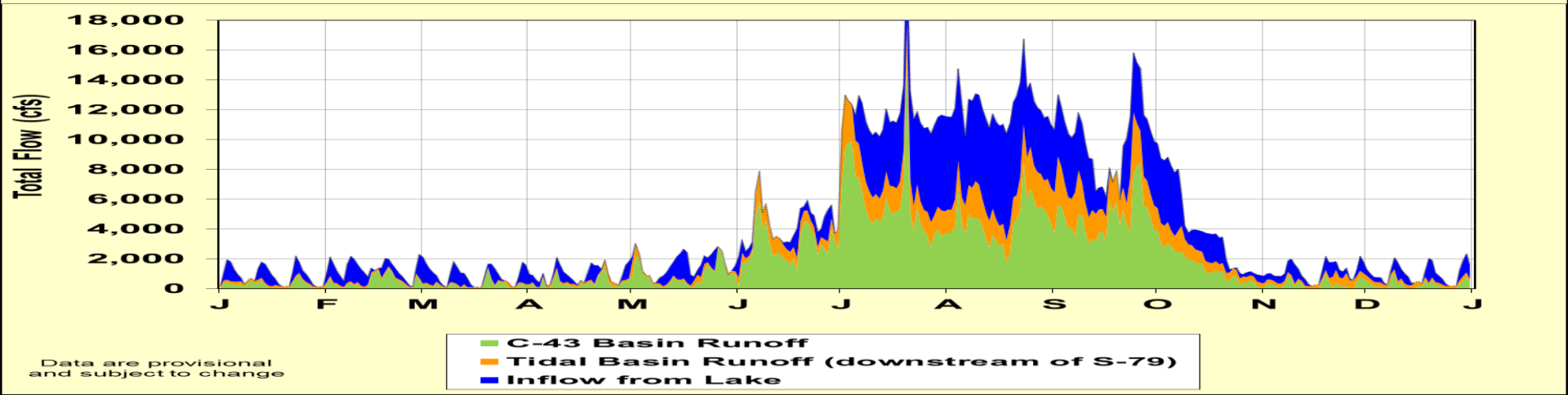


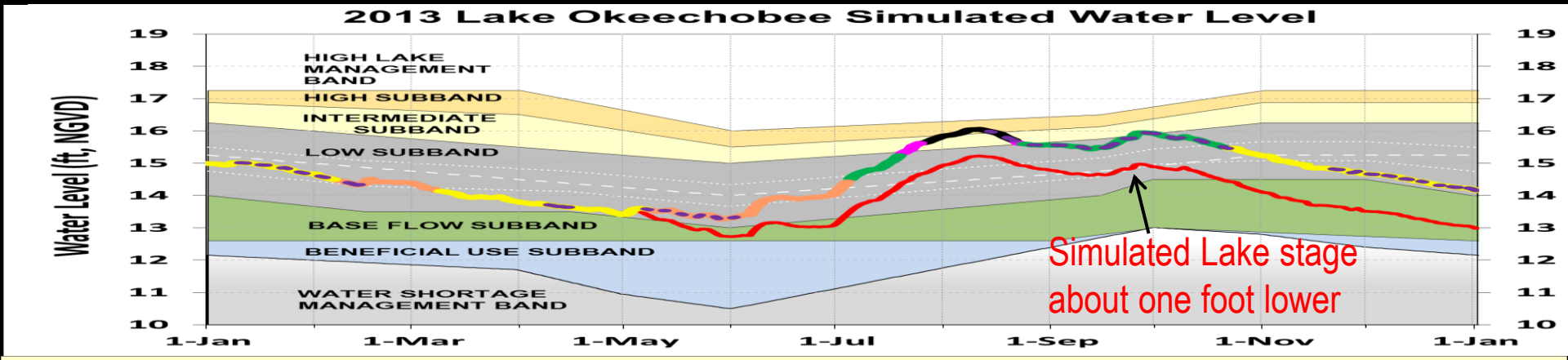
What if the southward Lake O releases were discharged using the maximum structure capacities?

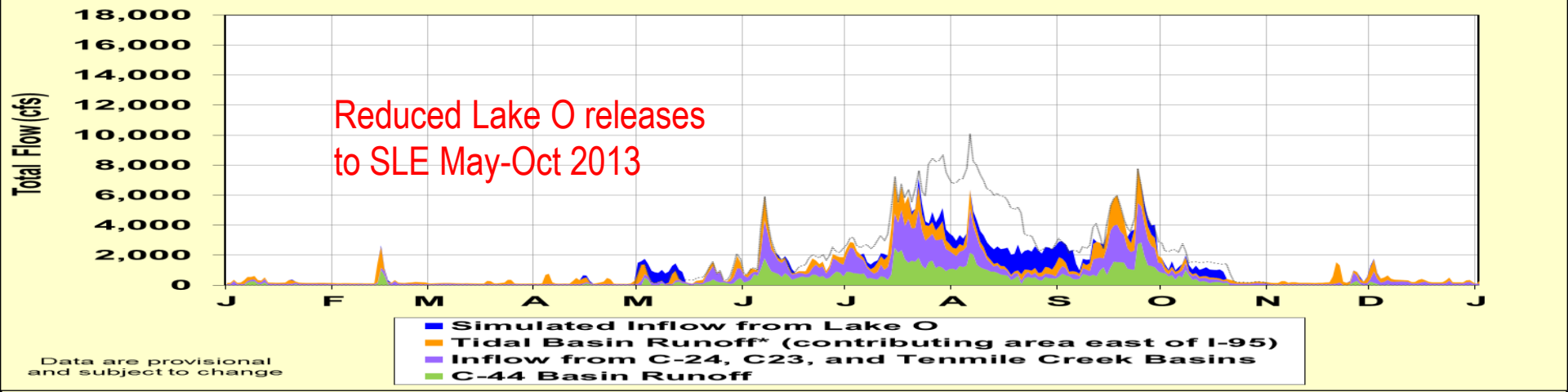
- Assumptions
  - Disregard STA treatment capability & Federal Consent Decree requirements
  - Disregard WCA regulations, water depth impacts on marsh vegetation, tree islands and wildlife, and endangered species
  - No runoff from EAA to primary canals; Lake O discharges have priority

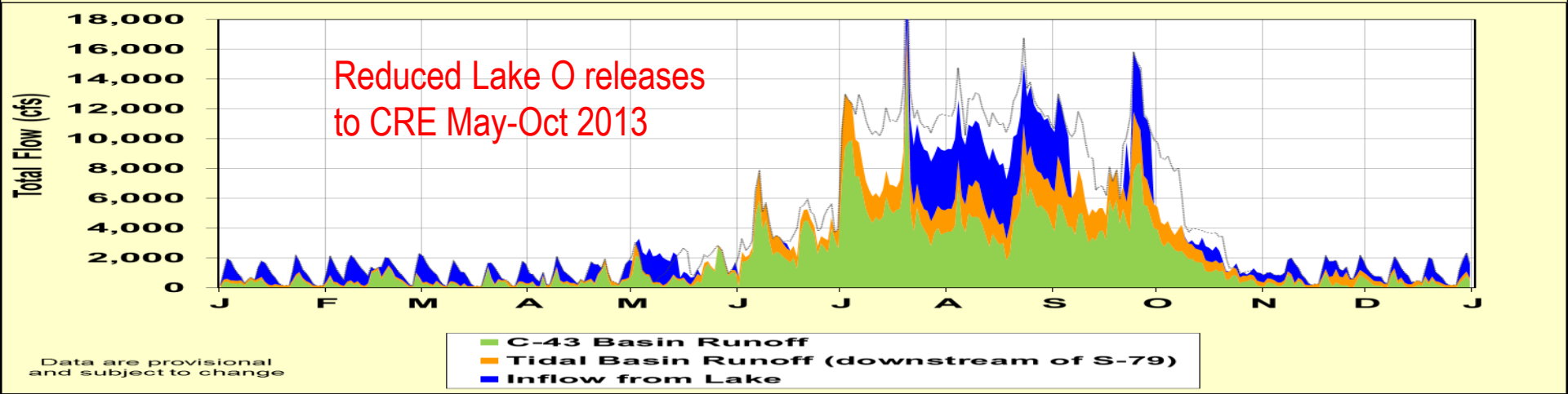

2013 Lake Okeechobee Simulated Water Level
Water Level (ft, NGVD)
HIGH LAKE MANAGEMENT BAND
HIGH SUBBAND
INTERMEDIATE SUBBAND
LOW SUBBAND
BASE FLOW SUBBAND
BENEFICIAL USE SUBBAND
WATER SHORTAGE MANAGEMENT BAND
19
18
17
16
15
14
13
12
11
10
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan


Total Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
Simulated Inflow from Lake O
Tidal Basin Runoff* (contributing area east of I-95)
Inflow from C-24, C23, and Tenmile Creek Basins
C-44 Basin Runoff
Data are provisional and subject to change


Total Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
C-43 Basin Runoff
Tidal Basin Runoff (downstream of S-79)
Inflow from Lake
Data are provisional and subject to change


2013 Lake Okeechobee Simulated Water Level
Water Level (ft, NGVD)
19
18
17
16
15
14
13
12
11
10
HIGH LAKE MANAGEMENT BAND
HIGH SUBBAND
INTERMEDIATE SUBBAND
LOW SUBBAND
BASE FLOW SUBBAND
BENEFICIAL USE SUBBAND
WATER SHORTAGE MANAGEMENT BAND
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan
Simulated Lake stage about one foot lower


Total Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
Reduced Lake O releases to SLE May-Oct 2013
Simulated Inflow from Lake O
Tidal Basin Runoff* (contributing area east of I-95)
Inflow from C-24, C23, and Tenmile Creek Basins
C-44 Basin Runoff
Data are provisional and subject to change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18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
Reduced Lake O releases to CRE May-Oct 2013
C-43 Basin Runoff
Tidal Basin Runoff (downstream of S-79)
Inflow from Lake
Data are provisional and subject to change

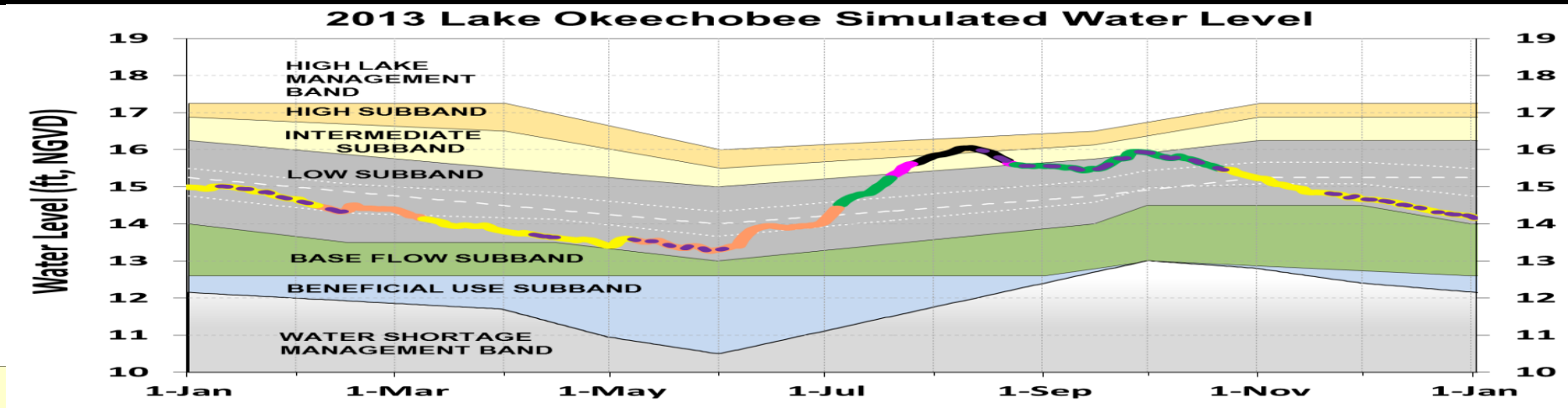
What if the southward Lake O releases were discharged using the maximum structure capacities?

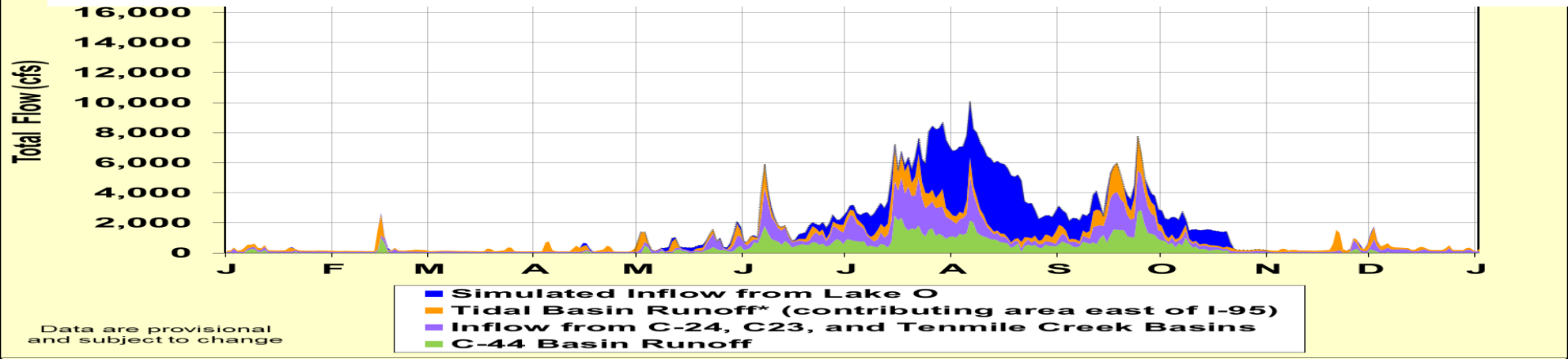
- Assumptions
  - Disregard STA treatment capability & Federal Consent Decree requirements
  - Disregard WCA regulations, water depth impacts on marsh vegetation, tree islands and wildlife, and endangered species
  - No runoff from EAA to primary canals; Lake O discharges have priority
- Findings
  - Flooding private property (EAA retains wet season rainfall ~ 36”)
  - STA vegetation damage and reduced treatment capability
  - Potential violation of Federal Consent Decree
  - Increased WCA water depths, potential reduction in marsh vegetation and reduced resistance to wave runup, increased risk of EC protective levee failure, tree islands and wildlife, and endangered species
  - Northern Estuaries: significant inflows from local basin runoff alone resulted in reduced salinities, oyster mortality, and die-off of grasses that are sensitive to estuary salinity

- Can more water be held in the Lake?

What if the excess Lake O water were held in Lake Okeechobee?

- Assumptions for this hypothetical what-if scenario
  - Disregard federal water control plan
  - Disregard Herbert Hoover Dike (HHD) risk





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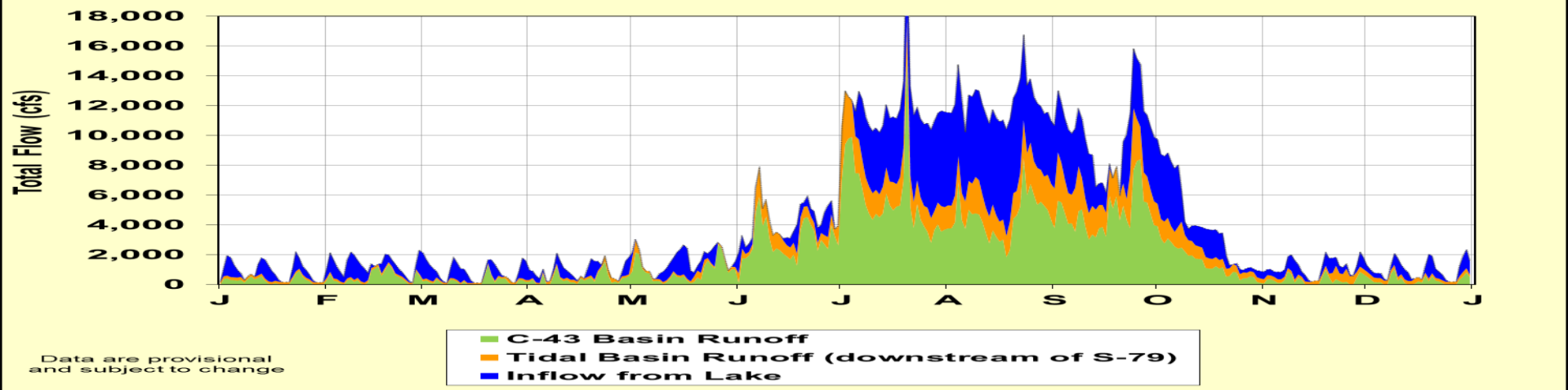

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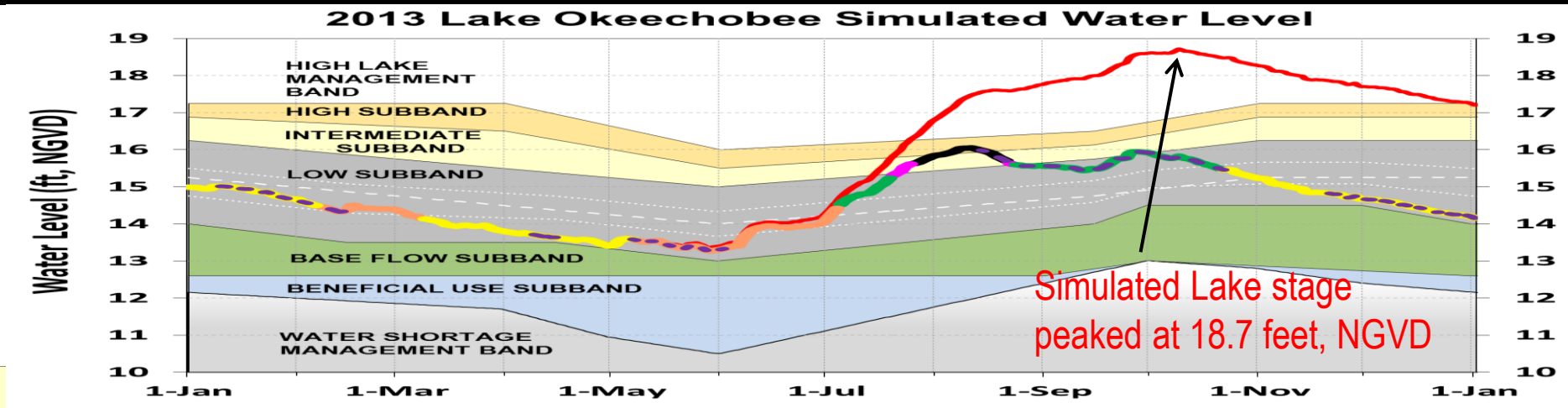
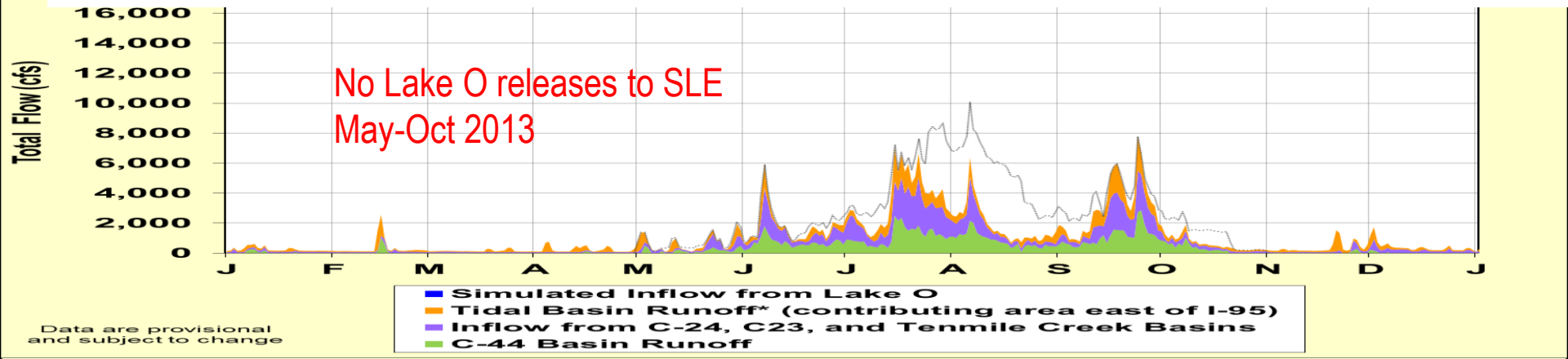

2013 Lake Okeechobee Simulated Water Level
Water Level (ft, NGVD)
HIGH LAKE MANAGEMENT BAND
HIGH SUBBAND
INTERMEDIATE SUBBAND
LOW SUBBAND
BASE FLOW SUBBAND
BENEFICIAL USE SUBBAND
WATER SHORTAGE MANAGEMENT BAND
Simulated Lake stage peaked at 18.7 feet, NGVD
19
18
17
16
15
14
13
12
11
10
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan


Total Flow (cfs)
No Lake O releases to SLE
May-Oct 2013
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
Simulated Inflow from Lake O
Tidal Basin Runoff* (contributing area east of I-95)
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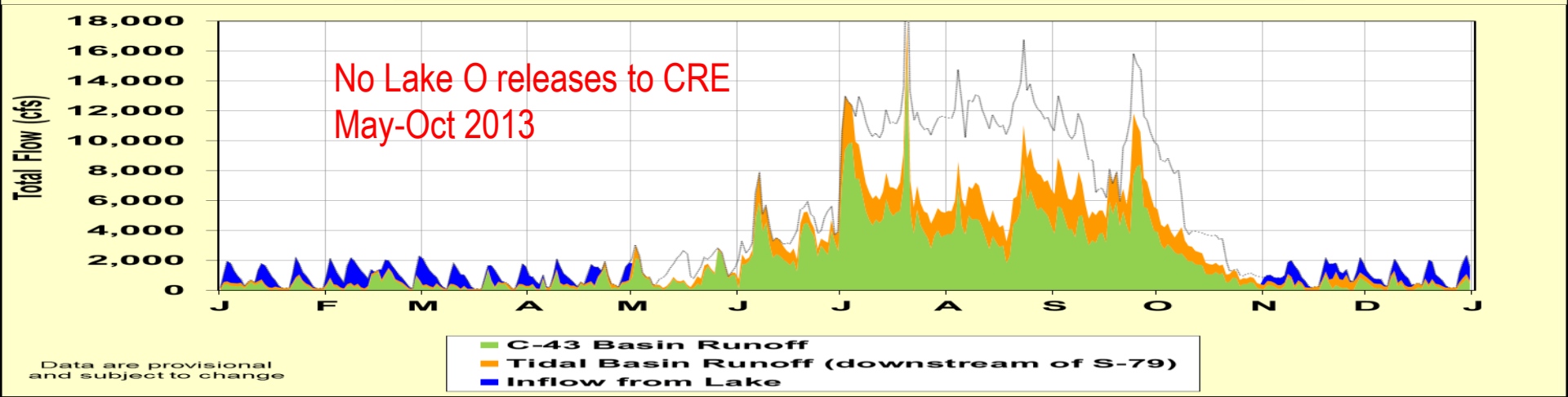
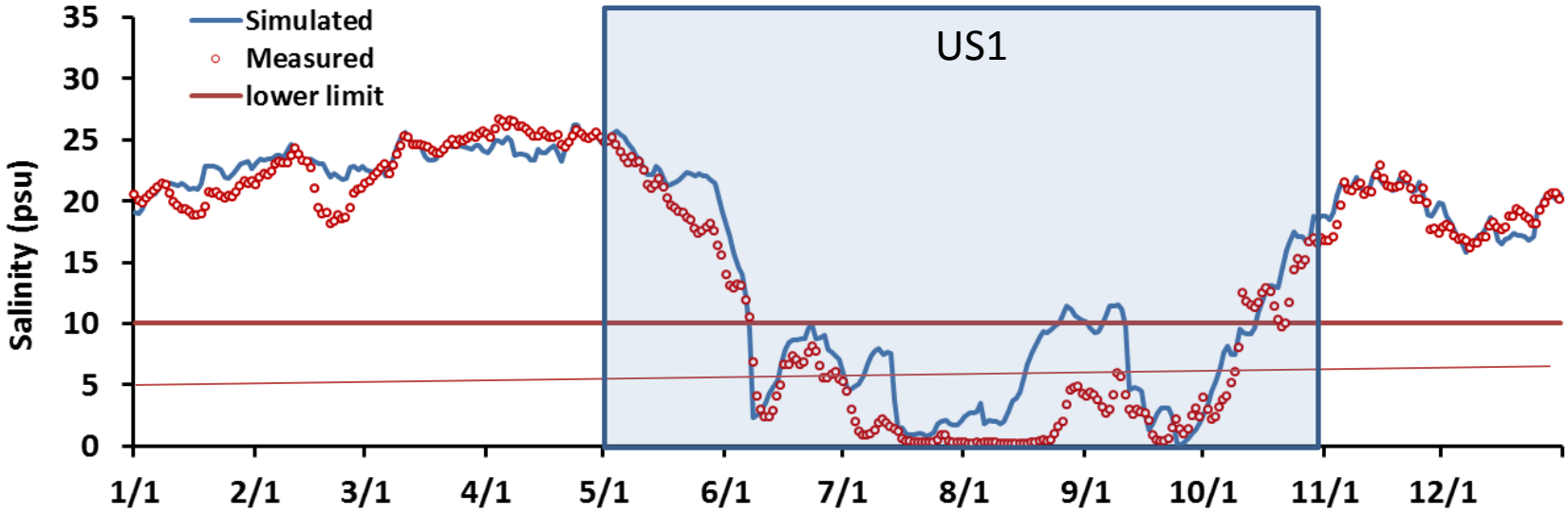
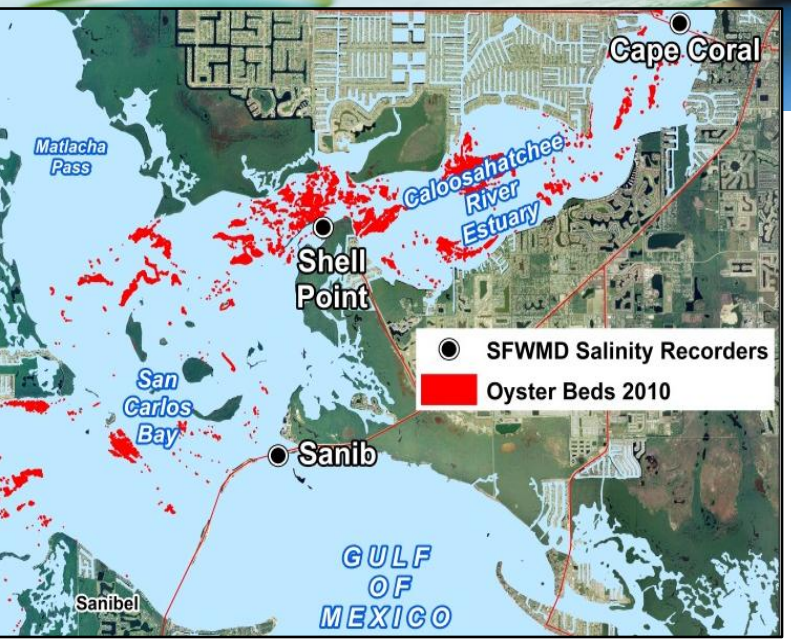

Total Flow (cfs)
No Lake O releases to CRE
May-Oct 2013
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
C-43 Basin Runoff
Tidal Basin Runoff (downstream of S-79)
Inflow from Lake
Data are provisional and subject to change

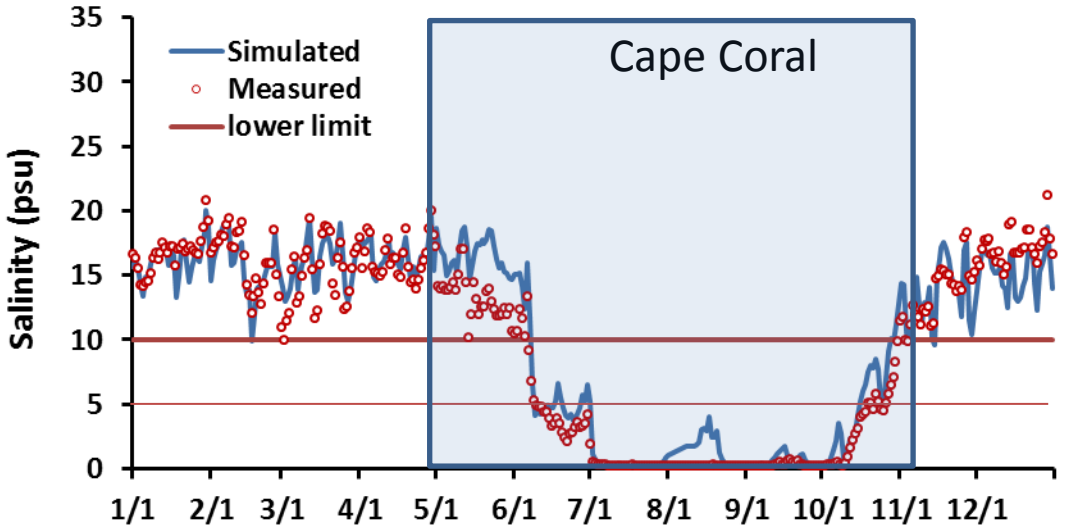
Salinity condition in the SLE

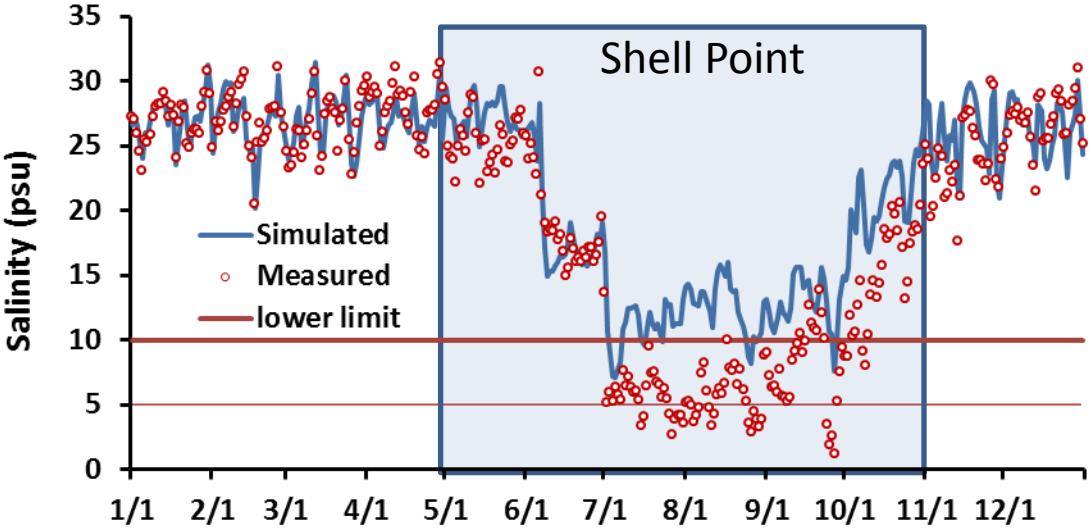
- The ARX salinity model calibrated with measured data was used to simulate salinity assuming LO releases were not made from May to October.
- Due to the large amount of watershed runoff, there would have been 79 consecutive days of salinity <10, and 33 days of consecutive days of salinity <5, from June to August even without LO releases. Therefore, basin runoff alone would have lead to oyster mortality in the mid-estuary.



Salinity condition in the CRE







- The same modeling method was used for the CRE where salinity at Cape Coral would have been <10 for 142 days, <5 for 106 days without LO releases (vs 147 days <10 and 131 days <5 with LO releases). Therefore, watershed runoff alone would have produced oyster mortality downstream of Cape Coral.
- At Shell Point, salinity would have risen just above 10 during the summer without LO releases; this would have alleviated stress on oysters near Shell Point.

What if the excess Lake O water were held in Lake Okeechobee?

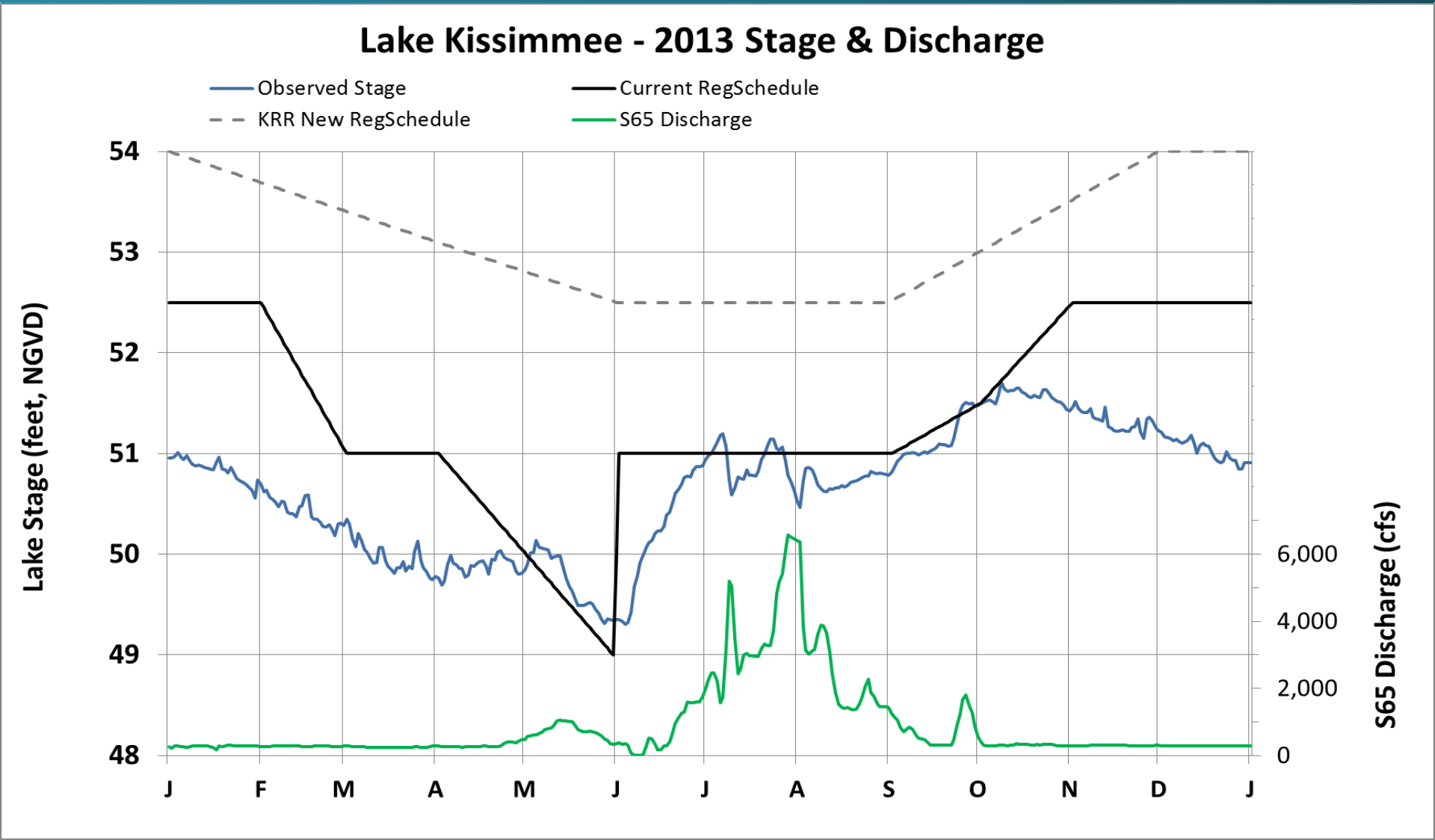
- Assumptions for this hypothetical what-if scenario
  - Disregard federal water control plan
  - Disregard Herbert Hoover Dike (HHD) risk
- Findings
  - Lake stage peaked at 18.7 feet, NGVD
  - Probability of HHD failure approximately 58% (USACE ‘07)
  - Northern Estuaries: significant inflows from local basin runoff alone resulted in reduced salinities, oyster mortality, and die-off of grasses that are sensitive to estuary salinity

- Can more water be held in the Kissimmee?

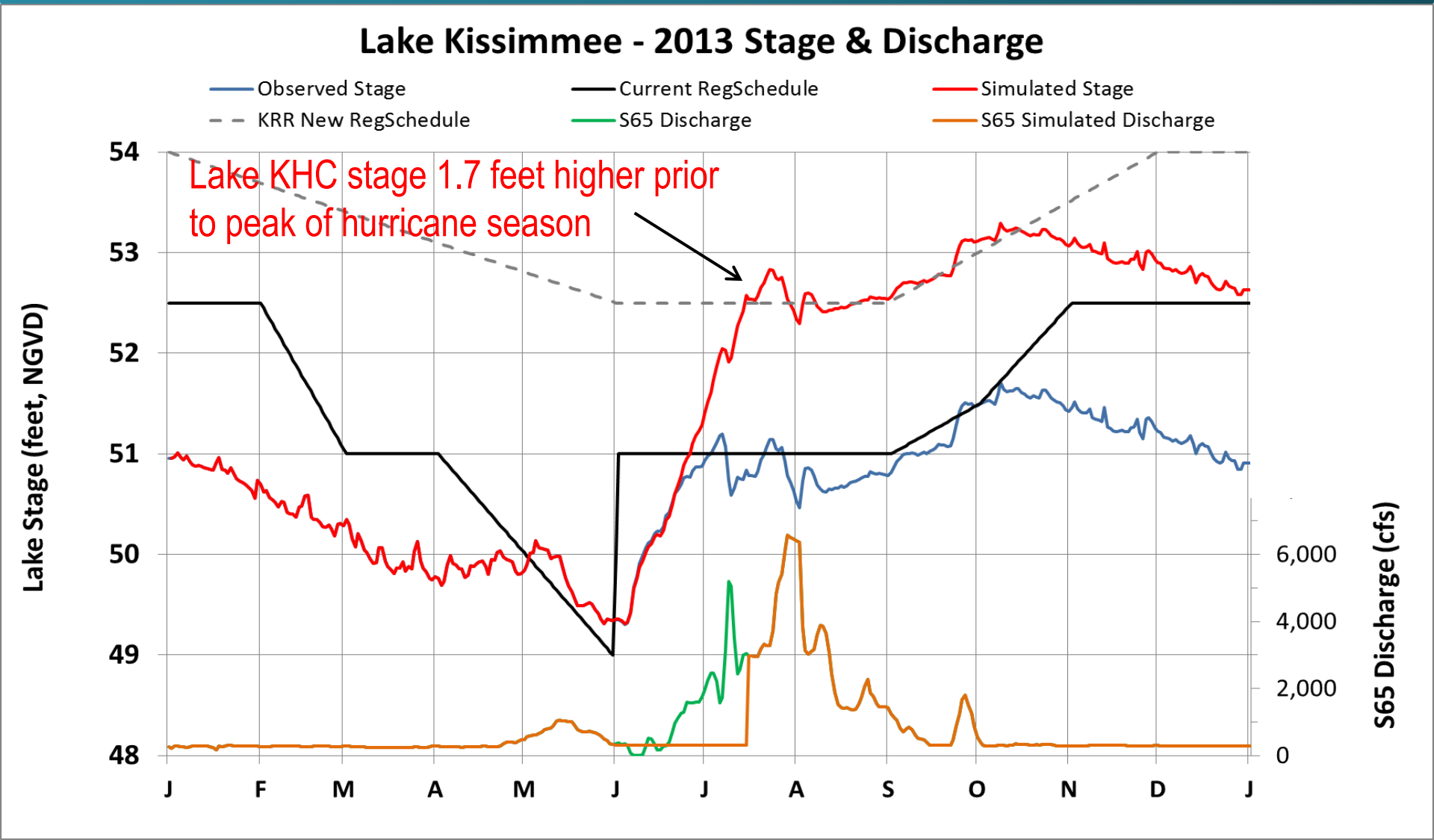
What if the more water were stored in the Upper Kissimmee Lakes?

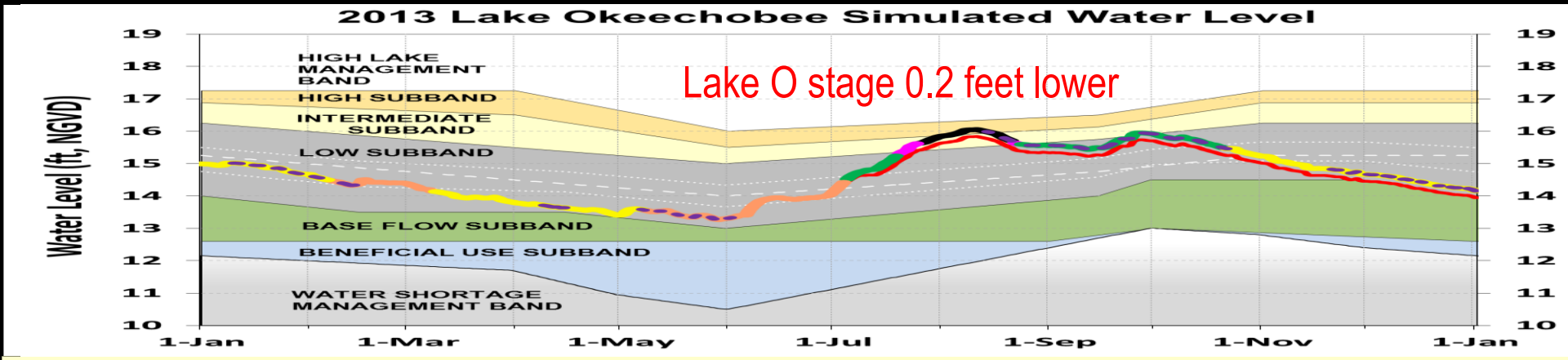
- Assumptions for this hypothetical what-if scenario
  - Disregard federal regulation schedule
  - Assume headwaters revitalization schedule in-effect for Lakes Kissimmee, Hatchineha, and Cypress (KHC)
  - Increase flooding risk to private property

Actual & Simulated Stages & Flows



Actual & Simulated Stages & Flows




2013 Lake Okeechobee Simulated Water Level
Lake O stage 0.2 feet lower
Water Level (ft, NGVD)
HIGH LAKE MANAGEMENT BAND
HIGH SUBBAND
INTERMEDIATE SUBBAND
LOW SUBBAND
BASE FLOW SUBBAND
BENEFICIAL USE SUBBAND
WATER SHORTAGE MANAGEMENT BAND
19
18
17
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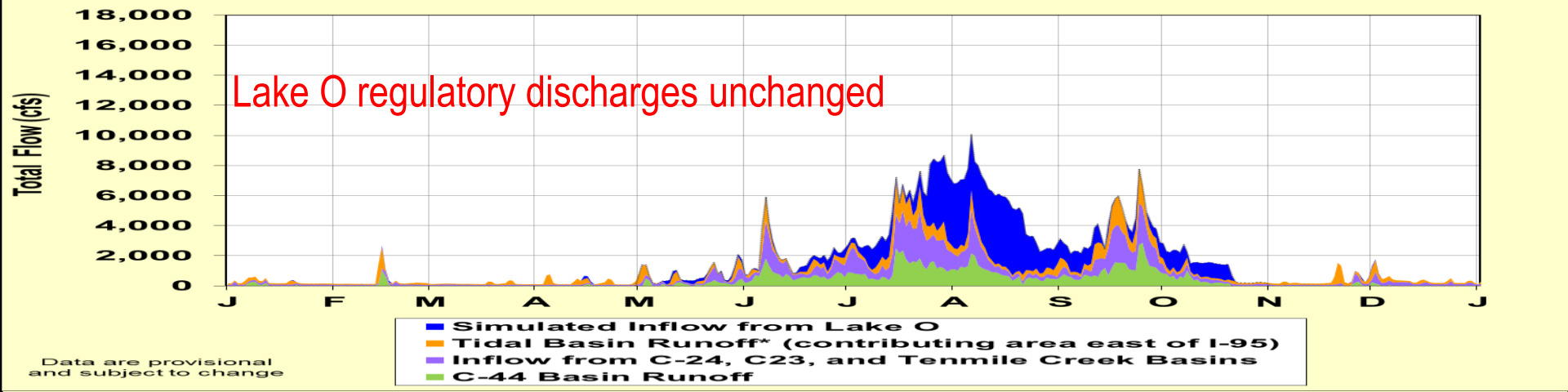
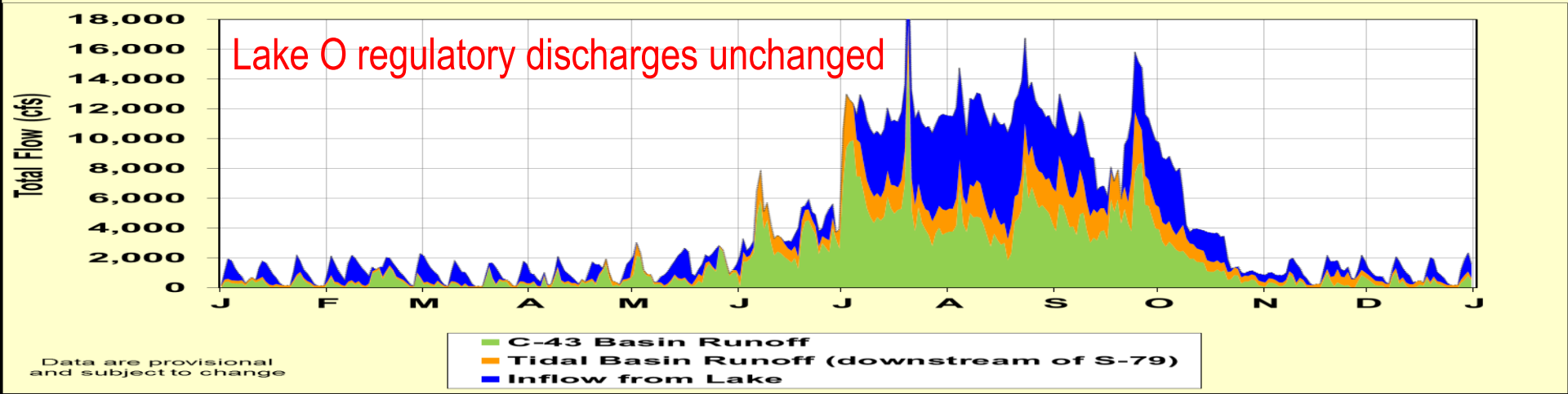
13
12
11
10
1-Jan
1-Mar
1-May
1-Jul
1-Sep
1-Nov
1-Jan


Lake O regulatory discharges unchanged
Total Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
Simulated Inflow from Lake O
Tidal Basin Runoff* (contributing area east of I-95)
Inflow from C-24, C23, and Tenmile Creek Basins
C-44 Basin Runoff
Data are provisional and subject to change


Lake O regulatory discharges unchanged
Total Flow (cfs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
J F M A M J J A S O N D J
C-43 Basin Runoff
Tidal Basin Runoff (downstream of S-79)
Inflow from Lake
Data are provisional and subject to change

What if the more water were stored in the Upper Kissimmee Lakes?

- Assumptions for this hypothetical what-if scenario
  - Allow stages to rise above current federal regulation schedule
  - Assume headwaters revitalization schedule in-effect for Lakes Kissimmee, Hatchineha, and Cypress (KHC)
  - Increase flooding risk to private property
- Findings
  - 97 kaf more water stored in Lakes KHC
  - Lake KHC stage 1.7 feet higher prior to peak of hurricane season
  - Lake O stage lower by about 0.2 feet
  - Lake O regulatory discharges unchanged
  - Northern Estuaries: significant inflows from local basin runoff alone resulted in reduced salinities, oyster mortality, and die-off of grasses that are sensitive to estuary salinity

Lessons Learned

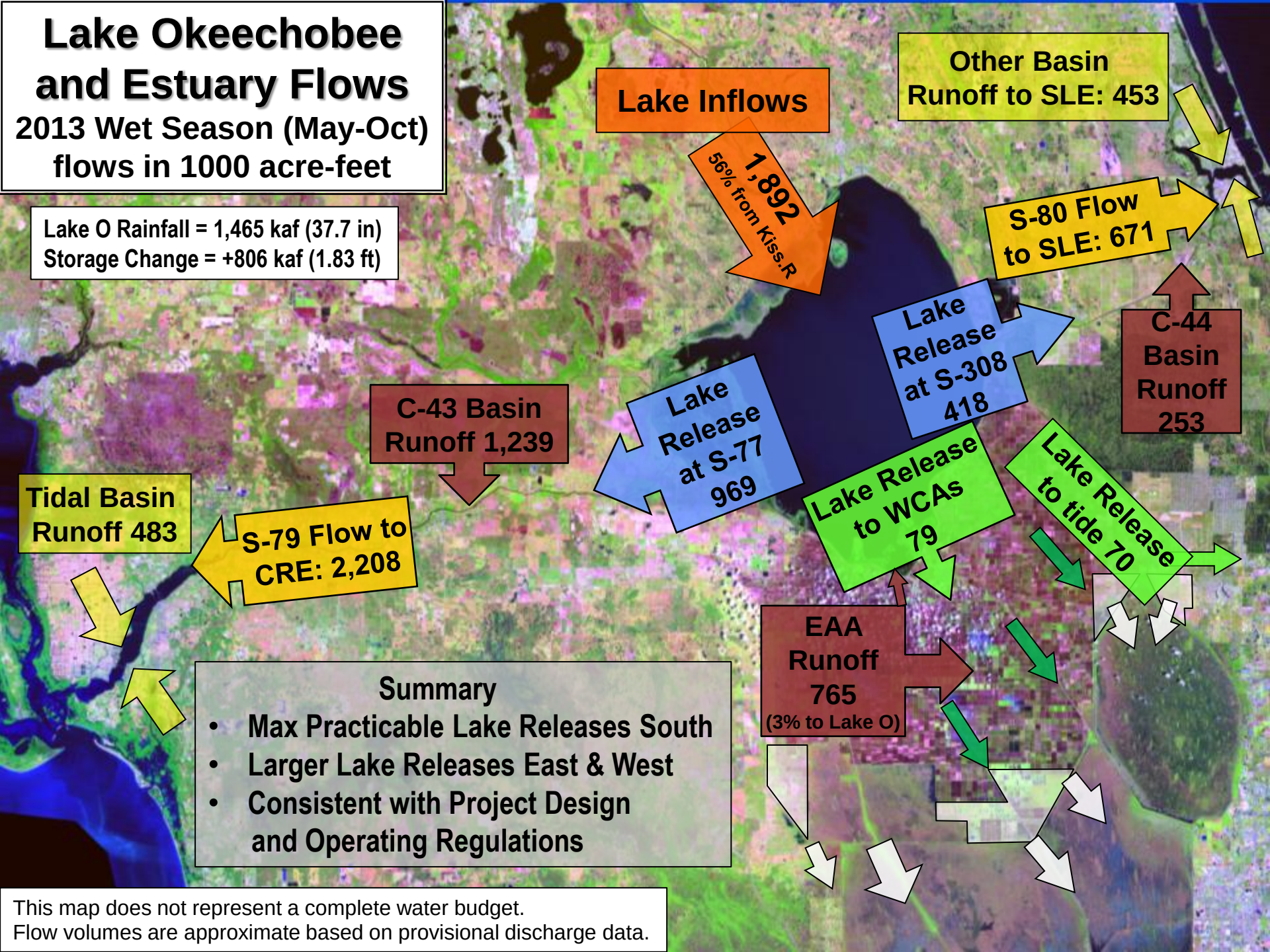
- The current water management system lacks sufficient storage and treatment facilities to significantly reduce damaging Lake discharges to the northern estuaries
- Special operations to pump WCA discharges to tide and to the SDCS provided some benefits to the northern estuaries
- Additional benefits might be achieved by utilizing the operational flexibility within the existing 2008 LORS
  - This would require development of Lake O release guidance for the middle and upper bands of the 2008 LORS
  - Process needed for release guidance development

Lessons Learned (con't)

- Continue coordination with FWC and DEP on sending water into Holey Land and Rotenberger Wildlife Management Areas
- Evaluate South Dade Conveyance System operations
- Investigate potential connection from Lake Okeechobee to STA-5/6 to increase capacity to treat Lake releases
- USACE and SFWMD to implement improved operations communication protocols

Lake Okeechobee and Estuary Flows

2013 Wet Season (May-Oct) flows in 1000 acre-feet



This map does not represent a complete water budget.
Flow volumes are approximate based on provisional discharge data.